

Sezhian M. V., Muralidharan C., Nambirajan T. and Deshmukh S.G.

DEVELOPING A PERFORMANCE IMPORTANCE MATRIX FOR A PUBLIC SECTOR BUS TRANSPORT COMPANY:
A CASE STUDY**DEVELOPING A PERFORMANCE IMPORTANCE
MATRIX FOR A PUBLIC SECTOR BUS
TRANSPORT COMPANY: A CASE STUDY****M. Vetrivel SEZHIAN***Dr. Paul's Engineering College, Villupuram - 605109, TamilNadu, India
vetrivel_sezhian@yahoo.co.in***C. MURALIDHARAN***Annamalai University, Chidambaram - 608002, TamilNadu, India
muralre@yahoo.co.in***T. NAMBI RAJAN***Pondicherry University, Pondicherry - 605014, Pondicherry, India
rtnambirajan@gmail.com***S.G. DESHMUKH***Indian Institute of Technology Delhi, New Delhi - 110016, India
deshmukhsg@hotmail.com***Abstract**

This paper presents a study of comparison of the importance attached by the service providers' and the customers' with respect to eighteen service characteristics towards the public transportation services provided by a bus company. The survey was conducted in three bus depots in one division of a state road transport undertaking (SRTU) in south India. The importance the SRTU and the customers attach to these characteristics indicates significant differences. This reveals the existence of a gap between customers' expectations and the service provided by the company. Finally the customer retention and customer development criteria have been identified.

Keywords: Performance importance matrix, Customer expectations, Public bus transport, Radar chart.

1. INTRODUCTION

Over the last few years, companies have gradually focused on service quality and customer satisfaction. This strategy is very profitable for both companies and customers, particularly for transit agencies and passengers. An improvement of the supplied service quality can attract further users. This fact could resolve many problems (e.g., helping to reduce traffic congestion, air and noise pollution, and energy consumption) because individual transport would be used less (Eboli and Mazulla, 2007).

In developing economies like India, transport sector particularly public sector bus companies are quite literally the lifeline as it transports more people from place to place be it urban, semi-urban, rural and mountainous terrains. In India, the Association of State Road Transport Undertakings has 58 members, who form the backbone of mobility for urban and rural population across the country operating over 1,15,000 buses, serving more than 65 million passengers a day and also providing employment to 0.8 million people (ASTRU, n.d.).

With the fast growing economy and the thrust for privatisation now has made this sector also to compete as does the private sector. Thus in this context, our study assumes importance as studies both the passengers or customers' expectations and also what the transport company perceives about these aspects. This in turn could help the company provide better service in future. As a result, the development of techniques for customer satisfaction analysis becomes necessary. These techniques will allow the critical aspects of the supplied services to be identified and the customer satisfaction to be increased (Cuomo, 2000). The techniques such as performance importance matrix and radar chart may be helpful in delivering customer satisfaction.

The main objectives of this paper are to:

1. Enlist the perceptions of the managers and passengers on a set of service criteria.
2. Develop a performance importance matrix (PIM).
3. Develop a radar chart to identify the relative strengths and weakness in the various performance criteria.
4. Identify the customer retention criteria and customer development criteria for the bus company.

This paper has been organised as follows: first a literature review of PIM and radar chart; and then the methodology applied to case study in a public sector company, followed by results and discussion and finally the conclusions obtained.

2. LITERATURE REVIEW

Performance importance matrix which is the matrix developed to place the perspectives of both managers and customers and the same is also later expressed in the form of a scatter graph has been used in this study. The literature on this subject reveals that researchers over the years have consistently used importance performance matrix as the first stage of Importance performance analysis (IPA) to gauge customer satisfaction and priority. Ali et al. (2009) investigate customers satisfaction level towards the public transportation services provided by a bus company; Mathesen and Solvoll

(2010) in a Norwegian ferry company; Lee et al. (2008) in computer firms; Cheng and Kung (2005) in an airline industry; Ainin and Hisham (2008) in a information service provider, Keyt et al. (1994), has done it in a restaurant, etc., to mention a few cases.

While literature from the perspectives of customers is abundant, the same from the perspectives of service providers namely the managers' is scarce. There are limited number of articles to date involving a comparison between end user and the service provider perspectives. To name a few who have done so are Rajesh et al. (2010) and Rahman and Selen (2010) in 3PL; and Kitcharoen (2004) in Thailand private Universities. But there has been no such work reported in a bus company. This paper addresses this gap through an empirical study conducted on both the service provider i.e., the managers of bus company and the customers, i.e., the passengers.

Since the used of radar chart in unison with PIM could aid in better understanding of performance criteria. Hence a short review of the same is discussed here. Radar chart has been used by Abreha (2007) for analysing public transport performance efficiency in Ethiopia, and Rajesh et al. (2010) for study of perceptions of 3PL managers and customers. It has also been used by Yeh (2007) for data analysis in clinical trials study, Duman and Heise (2009) for comparative policy stances for pay scales, and Moerke (1997) for growth rate of assets. Fleischer (1998) has used it for study of performance of a machine tool industry and Mosley and Mayer (1999) for benchmarking of national labour market. This shows the radar chart is also a vital tool in a wide range of fields.

3. RESEARCH METHODOLOGY

In our case study a State Road Transport Undertaking (SRTU) located in Tamil Nadu in South India, operating buses to five states has been chosen. It is one of the leading public sector bus transport corporation generating consistent returns as well rendering excellent service over the years. There are various divisions such as Chennai, Villupuram, Kumbakonam, Salem, Coimbatore, Madurai, Villupuram and has a fleet strength of about 1350 buses. This study has been conducted in the Villupuram division in three bus depots. The fleet strengths of these three depots are 98, 95 and 94 respectively. These depots each employ around 180 bus crew members, about 30 maintenance staff, 10 managerial staff, and 15 -18 administrative staff. The average number of passengers that travel every day is approximately one and a half lakh passengers for depot-I, around a lakh and twenty two thousand passengers for depot-II and less than one lakh passengers for depot-III.

The data was collected through a survey using a questionnaire developed by a group comprising of the three depot managers, transport officials of the SRTU and academicians through the brainstorming

methodology. The questionnaire consists of a set of eighteen questions on the customer characteristics. The questionnaire was first used to enumerate the importance attached by 150 passengers on these eighteen criteria through the interview method. They were asked to rate the same on a 1-5 Likert's scale. Prior to assessing the collected data, a reliability analysis was conducted, which gave a Cronbach's α value of 0.94 (min value of α is 0.7, (Nunnally (1978)). This proves that ability of the survey instrument to produce consistent results. The mean values of importance of the passengers and the mean value of importance assigned by managers (30 persons serving as managers and other officials of all three depots) are presented in Table-1. Based on the responses received, Principal Component Analysis (PCA) has been employed to extract components with Eigen values >1 (Sezhian et al. 2011). Two components were extracted with a total variance of 58.73%. The entire factor loadings were greater than 0.5, all the 18 sub-criteria do correlate with each other and satisfy the commonly used standard for factor loadings of 0.5, (Kannan and Tan, 2002). These two components were named as customer expectations and company responsibilities.

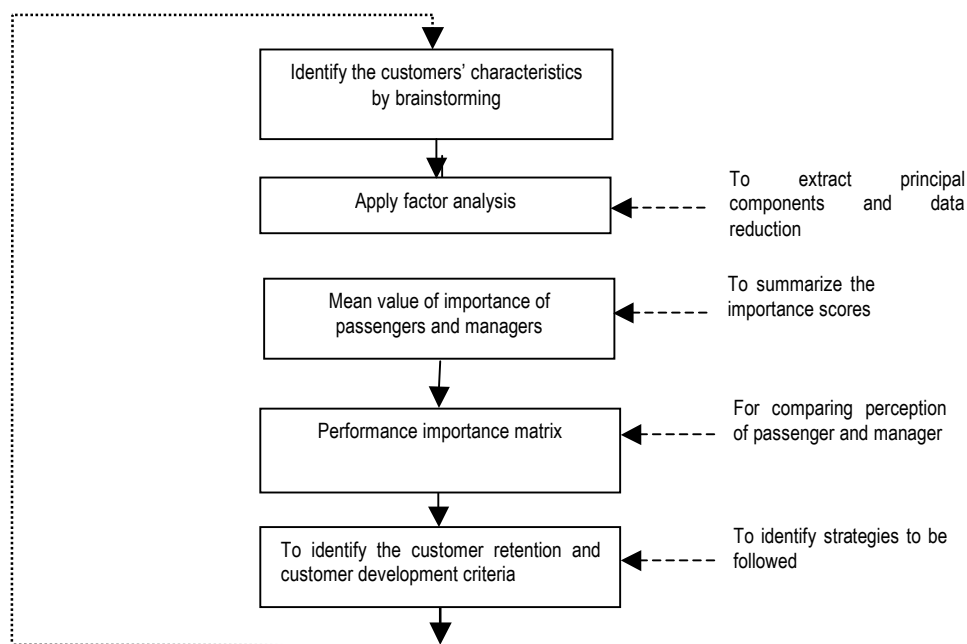


FIGURE 1 - THE FLOW CHART OF THE METHODOLOGY USED FOR DEVELOPING THE PERFORMANCE IMPORTANCE MATRIX FOR A BUS COMPANY.

Customer expectations are the factors which gives details of the facilities that the passengers expect inside the bus to make the journey comfortable. Company responsibilities are the factors which gives details of what responsibilities the passengers expect of the bus company. The customer expectations factors includes bus punctuality (C_{11}), seat comfort (C_{12}), cleanliness (C_{13}), lighting & entertainment (C_{14}), New fleet addition (C_{15}), seating for handicapped (C_{16}), seating for elderly (C_{17}), issue of proper ticket (C_{18}), in-time issue of ticket (C_{19}), and issue of proper change (C_{110}). The company responsibilities

factors includes stopping the bus at correct place (C_{21}), backup service during breakdown (C_{22}), provision for luggage (C_{23}), obey traffic rules (C_{24}), first aid facilities (C_{25}), driver behaviour (C_{26}), conductor behaviour (C_{27}) and information to passengers (C_{28}).

Figure 1 depicts the methodology adopted in this study. First the customers' characteristics are identified and their responses are analysed using PCA to extract principal components and for data reduction. Then the mean values of the importance of the managers and passengers are used to develop the PIM. Using the PIM the customer retention and customer development criteria are identified. The loop around shows that this processes needs to be periodically (every 3 to 5 years) repeated to review the relevance of the various criteria and add new ones if found necessary.

3.1. Construction of the Performance importance matrix

A crucial stage in the formulation of operations strategy is the derivation of a ranked (or rated) list of competitive factors such as quality, flexibility, cost, etc. This list is used in conjunction with an independently derived list of the organization's performance to prioritize each of the competitive factors to derive an importance-performance matrix (Martilla and James, 1977). Slack (1994) reported in his article how the matrix can be modified to reflect managers' perceived relationships between "importance", "performance" and "priority for improvement". Also a different zoning of the importance-performance matrix to that used by Martilla and James (1977) was proposed. The modified matrix allowed the managers to explore improvement priorities in their operations in an effective manner.

The data presented in Table 1 is used to construct the performance importance matrix (PIM). In Figure 2, the points seen in PIM are obtained by plotting the coordinate points of x component as mean value of manager response (x axis) and y component as mean value of passenger response (y axis). Two perpendicular lines passing through the coordinate (3, 3) divides the graph or plot into four quadrants namely, I, II, III and IV. The quadrant I (highest importance), attention needs to be given to these criteria. Failure to identify these characteristics can affect the company financially. These are the customer retention criteria. Criteria in quadrant II shows chance to achieve advantage by giving high importance. If the company concentrates on these criteria, it can improve its performance. This is because the customers feel that these criteria are very important to them but the managers have not perceived it as important. Added to this it could bring in additional customers in due course. These are the customer development criteria. Quadrant III shows that importance is low, and the criteria in this quadrant are the minor weaknesses and low priority. Quadrant IV shows there are resources may be wasted and should be arranged for other places. This may be because the customers feel these criteria may be less important to them.

3.2. Construction of the Radar chart

A radar or spider chart graphically shows the gaps in the organizational performance criteria. It also shows the important categories of performance and makes visual display of concentrations of strengths and weaknesses.

It displays how a number of organizational performance criteria have been evaluated by a team. Hence it becomes important that the initial evaluation include varied perspectives to provide an overall realistic picture of performance. The scoring range is 1 to 5 with 5 being full performance. The team develops an average or consensus score for each criterion. The radar chart is shown in Figure 4 has been plotted with the data in Table-1. It gives a visual display of the overlaps of the managers' and customers' perception more clearly.

TABLE 1 - THE MEAN VALUES OF PERCEPTION OF IMPORTANCE BY MANAGERS AND PASSENGERS.

Q. No.	Criteria	Sub-criteria	Mean value of importance by managers	Mean value of importance by passengers
1	Customer expectations	Bus punctuality (C ₁₁)	3.6	3.6
2		Seat comfort (C ₁₂)	2.8	3.4
3		Cleanliness (C ₁₃)	3.9	3.9
4		Lighting & entertainment (C ₁₄)	2.9	3.6
5		New fleet addition (C ₁₅)	3.8	3.8
6		Seating for handicapped (C ₁₆)	2.6	3.5
7		Seating for elderly (C ₁₇)	3.7	3.7
8		Issue of proper ticket (C ₁₈)	3.3	2.8
9		In time issue of ticket (C ₁₉)	3.9	4.02
10		Issue of proper change (C ₁₁₀)	2.6	3.3
11	Company responsibilities	Stopping bus at correct place (C ₂₁)	3.1	2.6
12		Backup service during breakdown (C ₂₂)	3.1	2.5
13		Provision for luggage (C ₂₃)	2.3	2.41
14		Obey traffic rules (C ₂₄)	2.5	2.2
15		First aid facility (C ₂₅)	3.1	2.7
16		Driver behaviour (C ₂₆)	3.5	2.9
17		Conductor behaviour (C ₂₇)	2.0	2.43
18		Information to passengers (C ₂₈)	2.9	2.45

The step-by-step procedure is given below for the construction and operation of radar chart.

1. A large circle is drawn and many spokes / radii are inserted as performance criteria.
2. On the circumference of the circle, each spoke is labelled for each performance criteria.

3. Each spoke is divided to show the rating scale. The centre of the circle as '0' for non performance and '5' for exceptional performance at the end of the spoke on the circle.
4. For each criterion, associated rating is plotted on the chart. Then the plotted points on all the spokes are connected. The enclosed central shape is highlighted as necessary for ease of viewing.
5. The radar chart graphically shows areas of relative strength and relative weakness, as well as depicting general overall performance.

4. RESULTS AND DISCUSSION

The PIM shows that the managers' perceptions on all the eighteen criteria are very much different from that of the customers. Sometimes they have given almost equal importance both on the higher and lower side; and in some they differ each other's, perception by giving higher or lower values. This is apparent from the PIM and radar chart presented in Figure 3 and Figure 4 respectively. Here five criteria are observed in quadrant-I, four criteria in quadrant-II, four in quadrant-III and five in quadrant-IV.

The criteria C_{11} , C_{13} , C_{15} , C_{17} & C_{19} placed in quadrant I indicates are of highest importance. Criteria in quadrant II, i.e., C_{12} , C_{14} , C_{16} & C_{110} , show chance for the company to improve its performance by concentrating upon. The customers will be satisfied, if these criteria which are very important are taken up for improvement. Quadrant III shows that the criteria C_{23} , C_{24} , C_{27} & C_{28} are of low priority. Quadrant IV shows the resources may be wasted in concentrating on criteria C_{18} , C_{21} , C_{22} , C_{25} , & C_{26} . These are clearly indicated in the Figure 2. The radar chart in Figure 3 depicts the overlaps of the importance of the managers' and that of the passengers', this could guide as to where the company is strong as well as weak. This gives an overall picture of the scenario.

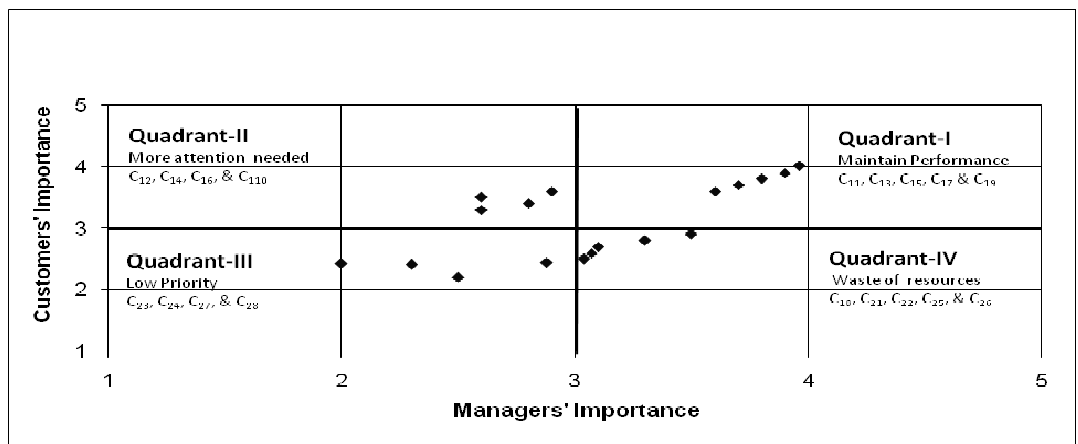


FIGURE 2 - PERFORMANCE IMPORTANCE MATRIX

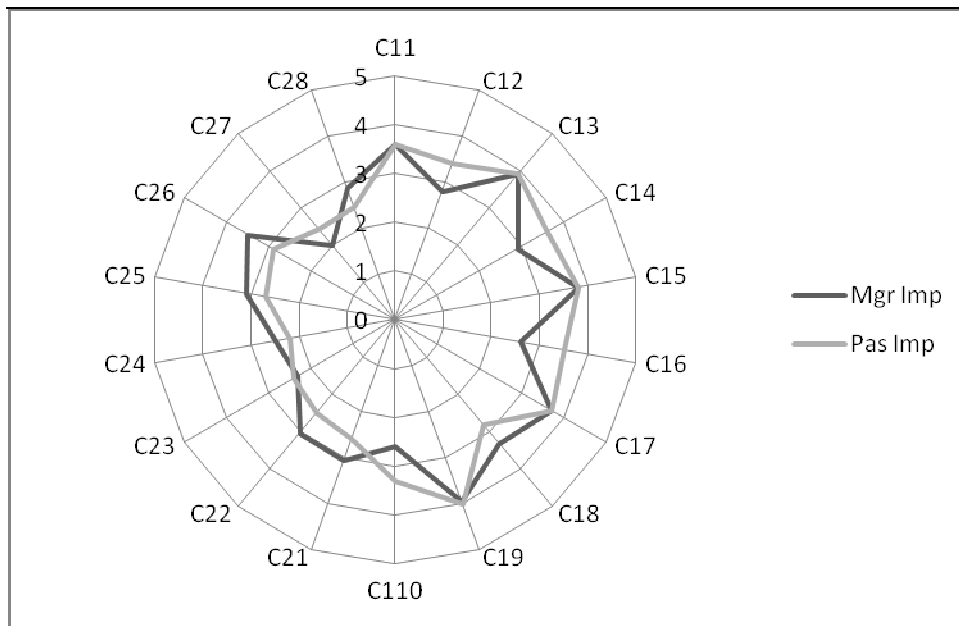


FIGURE 3 - RADAR CHART SHOWING OVERLAPS IN MANAGERS AND CUSTOMERS PERCEPTION

5. CONCLUSIONS

It is found from this study that consumers' perception towards the bus company can be further improved, by identifying the key factors and categorizing them according to their importance. It needs to take certain steps to improve some service attributes in order to meet customers' requirements. The improvements and the improvised facilities made from time to time will make the customer happy with the service provided by the organization. Every change made should be aimed keeping the perceptions of customers in mind. In due course it may attract more customers and do better business.

The study has focused on two service dimensions of a public sector bus transport and the importance of various performance measures as perceived by both company represented by its managers and the passengers / customers. The results have helped in identifying the factors in evaluating the service provided by the transport and evolving strategies for the future. The criteria in Quadrant-I, namely C₁₁, C₁₃, C₁₅, C₁₇ & C₁₉ has to get the highest priority of the top management and it should keep a close watch of the same as these are the customer retention criteria. The criteria in Quadrant-II, namely C₁₂, C₁₄, C₁₆, & C₁₁₀ are the ones that need immediate and focused attention of the front-line managers. These are the aspects that have so far received lesser attention of the managers, but the customers have attached higher importance. If these are given priority it will not only keep the existing customers happy but bring in new passengers or customers. Hence these are the customer development criteria. In Quadrant-III, the criteria C₂₃, C₂₄, C₂₇, & C₂₈ which are of low priority can be managed by second and lower level managers as they are minor weakness. C₁₈, C₂₁, C₂₂, C₂₅, & C₂₆ which are found in the

Quadrant-IV are the criteria of least priority for which the resources need not be wasted and hence be diverted elsewhere. This above-said exercise should be carried out once in 3 to 5 years as the importance attached to the various criteria may vary over time. There may be newer and more factors that could be identified for study during that time.

Another way of looking at PIM matrix is that factors which have mean customer response (MCR) values greater than 4 as a criterion that customer use to differentiate the services of one depot from that of another. They should keep up and excel on these factors. Those factors which have MCR values greater than 3 but less than 4 may be considered as a requirement for doing business in a particular market segment. It is important for the depot to meet the factors in this range as fulfilling these will not only position the depot to compete in the market but ensure success.

The radar chart has given an overall picture of perception differences of the managers and passengers. The use of this chart along with PIM could help prioritize managerial responses. Further statistical analysis will help throw more insight and better understanding of the perceptions of passengers that will lead to better service provider – customer relationship.

REFERENCES

- Abreha, D.A. (2007). *Analysing public transport performance using efficiency measures and spatial analysis: The case of Addis Ababa, Ethiopia*, M.S Thesis.
- Ainin, S. and Hisham, N.H. (2008). Applying importance performance analysis to information systems: An exploratory case study, *Journal of Information, Information Technology and Organisations*, Vol. 3, pp. 95-103
- Ali, Z.M., Ismail, M., Suradi, N.R.M. and Ismail, A.S. (2009). *Importance-performance analysis and customer satisfaction index for express bus services*, IEEE World conference on Nature and Biologically Inspired Computing (NaBIC) 2009, pp. 590-595.
- ASTRU (n.d.). Association of state road transport undertakings, India. Retrieved from www.astru.org.
- Cheng, M.F. and Kung, Y.J. (2005). Analysing airline service strategy through importance and performance analysis, *Journal of Eastern Asia Society for Transportation Studies*, Vol. 6, pp. 782-797.
- Cuomo, M.T. (2000). *La customer satisfaction, Vantaggio competitivo e creazione di valore*, Padova: CEDAM.
- Duman, A. and Heise, A. (2009). *Growth engines of south? South Africa's, Brazil's and Turkey's market constellations in comparison*, working paper, No. 09/09, Izmir University of Economics, Turkey.
- Eboli, L. and Mazzulla, G. (2007). Service quality attributes affecting customer satisfaction for bus transit, *Journal of Public Transportation*, Vol. 10 (1), pp. 21-34.

- Fleischer, M. (1998). Patenting and industrial performance: The case of the machine tool industry, discussion paper, *Social science research centre*, Berlin, ISSN Nr. 0722-6748. FS IV 98-9.
- Kannan, V.R. and Tan, K.C. (2002). Supplier selection and assessment, their impact on business performance, *Journal of Supply Chain Management*, Vol. 38, pp. 11-21.
- Keyt, J.C., Yuvas, U. and Riecken, G. (1994). Importance-performance analysis – A case study of restaurant positioning, *International Journal of Retail and Distribution Management*, Vol. 22 (5), pp. 35-40.
- Kitcharoen, K. (2004). The Importance-performance analysis of service quality in administrative departments of private Universities in Thailand, *ABAC Journal*, Vol. 24 (3), pp. 20-46.
- Lee, Y.C., Yen, T.-M. and Tsai, C.-H. (2008). Using importance performance analysis and decision making trial and evaluation laboratory to enhance order-winner criteria- A study of computer industry, *Information Technology Journal*, Vol. 7 (3), pp. 396-408.
- Marilla, J.A. and James, J.C. (1977). Importance performance analysis, *Journal of Marketing*, Vol. 41, pp. 77-79.
- Mathesen, T.A. and Solvoll, G. (2010). Service quality aspects in ferry passenger transport – examples from Norway, *European Journal of Transport Infrastructure Research*, Vol. 10 (2), pp. 142-157.
- Moerke, A. (1997). *Does governance matter? Performance and corporate governance structures of Japanese keiretsu groups*, discussion paper, Social science research centre, Berlin, ISSN Nr. 0722-6748. FS IV 97-43.
- Mosley, H. and Mayer, A. (1999). Benchmarking national labour market performance: A radar chart approach, discussion paper, *Social science research centre*, Berlin, ISSN Nr. Pp. 1011-9523. FS I 99-202.
- Nunnally, J.C. (1978). *Psychometric Theory*, McGraw Hill, New York.
- Rahman, S. and Selen, W. (2010). *Shippers-providers perception of third- party logistics services – An importance –performance matrix analysis*, Proceedings of the international conference on Industrial Engineering and Operations Management, Dhaka, Bangladesh.
- Rajesh, R., Pugazhendhi, S., Ganesh, K. and Muralidharan, C. (2010). Service dimension based descriptive study of third party logistics (3PL) service provider and 3PL users, *International Journal of Decision Making in Supply Chain and Logistics*, Vol. 1(1), pp. 1-8.
- Sezhian, V.M., Muralidharan, C., Nambirajan, T. and Deshmukh, S.G. (2011). Ranking of a public sector passenger bus transport company using principal component analysis: A case study, *Management Research and Practice*, Vol. 3(1), pp. 60-71.
- Slack, N. (1994). The importance-performance matrix as a determinant of Improvement priority, *International Journal of Operations and Production Management*, Vol. 14 (5), pp. 59-75.
- Yeh, S.-T. (2007). *Clinical adverse events data analysis and visualization*, Glaxo Smithkline, King of Prussia, PA, Retrieved from <http://www.lexjansen.com/pharmasug/2007/po/po10.pdf>.